

IN THE SPECIFICATION:

Please amend paragraph number [0001] as follows:

[0001] This application is a continuation of application Serial No. 10/205,834, filed July 25, 2002, now U.S. Patent 6,662,993, issued December 16, 2003, which is a continuation of application Serial No. 09/955,561, filed September 18, 2001, now U.S. Patent 6,464,123, issued October 15, 2002, which is a continuation of application Serial No. 09/337,782, filed June 22, 1999, now U.S. Patent 6,290,116, issued September 18, 2001, which is a divisional of application Serial No. 08/865,911, filed May 30, 1997, now U.S. Patent 6,000,599, issued December 14, 1999, which is a continuation of application Serial No. 08/597,616, filed February 6, 1996, now U.S. Patent 5,647,528, issued July 15, 1997.

Please amend paragraph number [0005] as follows:

[0005] Since the lead frames are formed continuously using stamping operations, they are typically continuously rolled on a suitable reel and provided for use. Such reeling operations of the lead frames cause the lead frames to have induced deformations therein leading to lead frames exhibiting longitudinal curvature and transverse curvature. Such lead frame curvature and any attendant deformation of the lead frame cause problems in the formation of reliable wire bonds with the contact pads of semiconductor devices and the individual lead fingers of the lead frame, particularly, when the size of the semiconductor is decreased, the number of ~~contacts~~ contact pads on the semiconductor device is increased, and the number of lead fingers on the lead frame is increased.

Please amend paragraph number [0023] as follows:

[0023] Referring to drawing FIG. 1, a semiconductor chip (die) 10 is shown being supported by the paddle 12 of a lead frame. A heat block 20 is used to heat the paddle 12, die 10, and lead fingers 14 during the wire bonding process. As shown, a suitable wire 16 has one end thereof ~~17~~ thereof bonded to a bond pad of the die 10. The wire 16 may be of any suitable type for connection and bonding purposes, such as gold, gold alloy, aluminum, aluminum alloy, etc.

The other end 18 of the wire 16 is shown being bonded to the end 15 of a lead finger 14 of the lead frame by a suitable bonding apparatus 26. The bonding apparatus 26 may be of any suitable type well known in the bonding area, such as a tailless thermosonic or ultrasonic capillary type bonding apparatus which dispenses wire during the bonding process. As previously stated, the lead finger 14 is in contact with the heat block 20 to heat the lead finger 14 to a suitable temperature for the bonding operation to ~~help insure~~ ensure a satisfactory wire bond. If desired, in the wire bonding operation, further shown in contact with lead finger 14 is a portion of a conventional fixed clamp 22 used to clamp portions of the lead frame during such bonding operations. The conventional fixed clamp 22 may be of any well known suitable type, such as those described hereinbefore, and is generic in shape. Further shown in drawing FIG. 1 is independently actuated lead clamp 24 used in place of or in addition to the conventional fixed clamp 22 to maintain the lead finger 14 in position during the bonding process. The ~~independent~~ independently actuated lead clamp 24 helps ~~insure~~ ensure that the lead finger is in contact with the heat block 20 during the bonding process and helps minimize any deflection of the end 15 of the lead finger 14 so that the bonding apparatus 26 accurately, precisely contacts the end 15 to provide the desired wire bond. The action of ~~independent~~ independently actuated lead clamp 24, and if desired the additional use of conventional fixed clamp 22, provides improved clamping of a lead finger 14 during the wire bonding process as well as ~~insures~~ ensures that the lead finger 14 is in intimate contact with the heat block 20 for effectiveness.

Please amend paragraph number [0025] as follows:

[0025] The ~~independent~~ independently actuated lead clamp 24 may be of any suitable shape for use in independently clamping the lead finger 14, in place of the use of conventional fixed clamp 22, such as square, semicircular, rectangular, arcuate, etc. Also, as shown, the ~~independent~~ independently actuated lead clamp 24 may be resiliently mounted through the use of a shoulder 50 thereon abutting a spring 52 to control the amount of the force exerted on any lead finger 14 during the wire bonding operation. If desired, the ~~independent~~ independently actuated lead clamp 24 may include insulation or cushioning 25 on the end thereof. The

~~independent~~ independently actuated lead clamp 24 is actuated independently of bonding apparatus 26 and has the capability of independent movement along the x-axis, y-axis and z-axis with respect to the bonding apparatus 26. The ~~independent~~ independently actuated lead clamp 24 is also free to move about the bonding apparatus 26 and the central axis of the die 10 so that any lead finger 14 that is to be connected to bond pads on the die 10, regardless of location, may be accommodated. The ~~independent~~ independently actuated lead clamp 24 does not need to be, and preferably is not, concentrically centered about the bonding apparatus 26 so that it will not interfere with the operation thereof. Any desired number of ~~independent~~ independently actuated lead clamps 24 may be used about the bonding apparatus 26 to minimize the amount of movement of the ~~independent~~ independently actuated lead clamp 24 between wire bonding operations. The ~~independent~~ independently actuated lead clamps 24 may be located in quadrants about the die 10, or in any manner as desired.

Please amend paragraph number [0026] as follows:

[0026] Referring to drawing FIG. 2, a ~~lead-over-chip~~ lead-over-chip configuration using the present invention is shown. The lead fingers 14 are located over the chip (die) 10 for wire bonding thereto. In such a configuration, the lead fingers 14 are secured to the die 10 by insulating adhesive strips 30. During the bond operation, one or more of the ~~independent~~ independently actuated lead ~~clamp 24~~ clamp 24, clamps the end 15 of lead finger 14 prior to the bonding of a wire 16 thereto by one or more of the bonding apparatus 26. The ~~independent~~ independently actuated lead clamp 24 applies sufficient pressure to the end 15 of the lead finger 14 to compress the insulating adhesive strips 30 to ~~insure~~ ensure a satisfactory bond between the end of any wire 16 and the end 15 of the lead finger 14.

Please amend paragraph number [0027] as follows:

[0027] Referring to drawing FIG. 3, a die 10 is shown having a plurality of wires 16 bonded thereto. As shown, one or more of the ~~independent~~ independently actuated lead clamps 24 contacts the end 15 of lead finger 14 aft of the area of the wire end 18 to the lead finger 14.

The bonds of the wire end 18 to the end 15 of the lead finger 14 are typically a wedge type wire bond, although a ball bond may be made if desired. As shown, the heat block 20 is in contact with the paddle 12 of the lead frame and the lead fingers 14.

Please amend paragraph number [0028] as follows:

[0028] Referring to drawing FIG. 4, a portion of a lead finger 14 is shown in conjunction with a bonding apparatus 26 and modified independent lead clamp 22'. The modified independent lead clamp 22' is formed having a modified end or foot 23 thereon to provide a larger clamping area of the modified independent lead clamp 22' on the end 15 of the lead finger 14 during bonding operations. The modified end or foot 23 is substantially the same width as the lead finger 14 and may be mounted to have articulated movement about the end of the modified independent lead clamp 22', such as using a pin 125 extending through suitable apertures in a pair of ears 27 attached to the foot 23 and the end of the modified independent lead clamp 22' for illustration purposes.

Please amend paragraph number [0029] as follows:

[0029] Referring to drawing FIG. 5, an independent conventional fixed clamp ~~22~~ is 22" is shown having a modified end or foot 23' located on the end thereof. The end or foot 23' may be integrally attached to the independent conventional fixed clamp ~~22~~ ~~or 22"~~ or may have an articulated mounting arrangement, such as shown in drawing FIG. 4. In this instance, the modified end or foot 23' is generally semicircular, or arcuate, in configuration so as to engage a large portion of the end 15 of the lead finger 14 surrounding the bonding apparatus 26 during the wire bonding operation to hold the end 15 in position.

Please amend paragraph number [0030] as follows:

[0030] Referring to drawing FIG. 6, the ~~independent~~ independently actuated lead clamp 24 is shown in relation to the bonding apparatus 26 on the end 15 of a lead finger 14 as well as further being shown in relation to a second independently actuated lead clamp 150

located thereon during wire bonding operations. The second independently actuated lead clamp 150 may be of any suitable type and structure such as described and illustrated hereinbefore. The independently actuated lead clamp 24 and second independently actuated lead clamp 150 may be actuated independently of each other and independently of the bonding apparatus 26 as described and illustrated hereinbefore.

Please amend paragraph number [0031] as follows:

[0031] Referring to drawing FIGs. 1 through 3, in the method of the present invention, a die 10 is positioned within the bonding area of the bonding apparatus 26. If desired, for use in addition to an individual ~~independent~~ independently actuated lead clamp 24, a conventional fixed clamp 22 serves to help straighten the lead frame and position the lead fingers 14 during subsequent bonding operations. Next, the die 10 and the lead finger 14 are heated to the desired temperature before bonding operations by the heat block 20. At this time, the ~~independent~~ independently actuated lead clamp 24 is engaged, moved to the appropriate lead finger 14 which is to have a wire bonded thereto, and the independently actuated lead clamp 24 actuated to clamp the end 15 of the lead finger 14 against the heat block 20 or the insulating adhesive strip 30. The wire bonding apparatus 26 is then actuated to form a wire bond on end 17 of wire 16 to an appropriate bond pad on die 10. After the formation of the bond of end 17 of wire 16 to the bond pad of die 10, the bonding apparatus is moved to appropriate end 15 of lead finger 14 for the formation of a suitable wire bond thereto by end 18 of wire 16. After the formation of the bond of the end 18 of wire 16 to the end 15 of lead finger 14, the ~~independent~~ independently actuated lead clamp 24 and the bonding apparatus 26 are actuated to substantially simultaneously remove the independently actuated lead clamp 24 and the bonding apparatus 26 from the end 15 of the lead finger 14. Alternately, the bonding apparatus 26 is actuated to remove the apparatus from the bond location at the end 15 of the lead finger 14 either prior to or after the removal of the ~~independent~~ independently actuated lead clamp 24 from a lead finger 14. During the removal of the bonding apparatus 26 from the end 15 of the lead finger 14, if used in addition to the ~~independent~~ independently actuated lead clamp 24, a conventional fixed clamp 22, if in contact

with a lead finger 14, supplies the necessary force to retain the finger 14 in position relative to other lead fingers located around die 10, both bonded and unbonded. As previously stated, it is not necessary for the ~~independent~~ independently actuated lead clamp 24 to remain in contact with the end 15 of lead finger 14 during the removal of the bonding apparatus 26 therefrom. After the wire 16 has been bonded to the desired bond pad of die 10 and end 15 of lead finger 14, the process is repeated until all desired wire bonds between lead fingers 14 and bond pads of die 10 are completed.

Please amend paragraph number [0032] as follows:

[0032] If desired to have additional clamping of the lead finger 14, either a conventional fixed clamp 22 and/or an ~~independent~~ independently actuated lead clamp 24 may be used with the bonding apparatus 26. The ~~independent~~ independently actuated lead clamp 24 may be actuated and moved from the lead finger 14 with, before or after the removal of the bonding apparatus 26 from the lead finger 14.

Please amend paragraph number [0033] as follows:

[0033] It will be understood that the present invention may have changes, additions, deletions, modifications, and sequence of operation which fall within the scope of the invention. For instance, the fixed clamp may be eliminated and a second ~~independent~~ independently actuated lead clamp used in its place.